# THE COÖRDINATION OF LATIN WITH FIRST-YEAR ALGEBRA

By Archibald W. Smalley
Hyde Park High School, Chicago

We may believe fully in the cultural and disciplinary values of Latin, and be also in thorough sympathy with the tendency to make Latin of direct help in the use and understanding of English. Because of such a sympathy I have long taught in Latin classes the derivation and meaning of English words, and of late with increasing emphasis.

Experience shows that practically all pupils need instruction in the method of using the dictionary to determine etymology, and that many first-year pupils require definite guidance of an elementary kind. To illustrate this last statement, let me give two extreme cases. A boy was asked to find derivatives from *vir*. He presented English words containing the syllable *man*, such as *man*, *manage*, etc. A girl presented a set of English words all having the same meaning as the Latin word she was handling, without regard to their different etymologies.

I have found that the best results are secured, not by occasionally giving a number of Latin words to all the pupils in the class, but by a daily assignment of one word to one pupil, with the direction that he place on the board before the class period all the English derivatives he can find along with the definition of each. The teacher can correct, add to or subtract from the pupil's list, explaining the connection with the Latin original where this is not clear, and indicating the common words which all must copy into their notebooks, and for which all will be held responsible.

Such etymology work has at least four good results. (1) It makes the Latin teacher a learner with his pupils, and continually surprises him by revealing how little he really knows about the derivation of words. He finds it exhilarating to discover the etymology of such a word as *umpire*, or the difference in origin of the second syllables in *reserve* and *deserve*. (2) It interests the

Latin students and the teachers of other subjects, and makes them see one practical value of Latin. (3) It shows the great debt our language owes to Latin. (4) It enables the Latin teacher to make the first-year work more valuable to those who go no farther. My experience shows that etymology work more than pays for the time it takes, both in direct result and in the interest it creates.

This paper is the record of an attempt to coördinate first-year Latin with first-year algebra. It gives also some conclusions which may be drawn from the attempt. Work has already been begun on the coördination of Latin with first-year subjects other than algebra, such as general science, music, drawing, gymnasium, woodwork, and English.

Coördination may be secured in other ways, but the aim of this paper is to show how, and to what extent, the nomenclature of algebra may be taught in Latin classes, especially in those of the first year. The method is to tabulate in alphabetical order, the technical and semi-technical words of algebra. The words are those found in the index of Wells and Hart's First Year Algebra, 1912. To these have been added numerous other words occurring in the preface, introduction, and scattered through the pages of the text-book. It may be said, in passing, that in the case of some subjects, such as music, drawing and cooking, the teachers of those subjects have been good enough to furnish a list, to which additions have been made as it seemed advisable.

After this tabulation of the nomenclature of algebra, the etymology of each word was ascertained or verified. The words were then arranged and counted in two groups; first, those ultimately from Latin, including the hybrids coming from both Latin and Greek; second, those ultimately from other languages. The last step was to determine in what semester of high-school Latin each word might first be taught. Here it was necessary to assume exact uniformity in teaching, where only substantial agreement exists. For first-year Latin the stems found in the special vocabularies of D'Ooge's Latin for Beginners served as a basis. In second-year Latin, it was assumed that the Helvetian campaign was read the first semester, and books 2, 3 and 4 of the Gallic War, during the second semester.

In following this method two things became evident. (1) That words must be, and should be taught from the nearest approach. To illustrate. To teach the derivation of *solution*, we must not wait for *solutio*, we must teach it from *solvere*. To teach the derivation of *solve*, we must not wait for the ultimate *se+luere;* we must use the nearer *solvere*. To teach the derivation of *result* we must not wait for *resultare*, or even *resilire*, we must use the first compound of *salire* that occurs. To teach the derivation of *brace* we may use the Latin *bracchium*, even though the Greek *brachion* gives the ultimate derivation. (2) The second thing to become evident is this. The teaching should not be of too scholarly a character, nor yet too inexact. We may rest content with tracing *power* to *posse*, without giving the intermediate step of Late Latin *potere*. We should not mention the assumed form *similaris*, but show the origin of *similar* in *similis*. We need not say that *monomial, trinomial*, and *polynomial* were formed in imitation of *binomial;* but we should show that *binomial* is a mistaken form of *binominal*. We should point out cognates whenever the helpfulness of such a course seems to justify it; but cognates should never be confused with derivatives.

The subjoined list contains 156 words. To obtain this number, two or more English words which come from the same Latin source, have been counted as one. If every word were counted, the grand total would reach 193 instead of 156. In this way, *multiple, multiply, multiplier, multiplicand* and *multiplication*, have all together counted as one. So with *add, subtract, divide*, and related English words. So with twenty or more pairs, such as *equal* and *equation, letter* and *literal, miscellaneous* and *mixed*. So with such words as *determinate* and *indeterminate*, where the difference lies only in the negative prefix.

On the other hand, the words in other groups have been counted separately; *angle, triangle, rectangle; monomial, binomial, trinomial, polynomial; factor* and *coefficient; ordinate* and *coördinate; ascending* and *descending; similar* and *dissimilar; complementary* and *supplementary;* all these because of a difference in the prefix. *Minus* and *minuend, complex* and *complicate*, are distinguished because each pair comes from different, though

related, Latin words.  *Parallelogram* adds a new root to that in the word *parallel*.

Of these 156 words, or groups of words, 128 are from Latin, and three are from Latin and Greek, a total of 131, or 84%. Seventeen are from Greek through Latin; two directly from Greek, and one each from Scandinavian and Old High German. Two are ultimately from Arabic, and one each from Persian and Celtic.  Every one of the 37 words not counted is of classical origin.

Of the 131 words, for the teaching of which the Latin teacher might hold himself responsible, 27 can be associated with the regular teaching in the first semester; 46 in the second semester; 17 in the third; 14 in the fourth; and 13 in the third year, a total of 117.  The other fourteen can not be taught at all in the first three years of Latin, provided we do not go beyond the usual vocabularies of those years.  The algebra pupil must know the meaning of these 131 words during his first year in high school; in the case of most of the words, during his first semester.  The Latin teacher cannot economically throw light on more than 20.6% during the first semester, nor on more than 55.7%, all told, during the whole of the first year.

Some general conclusions may be drawn from this attempt to coördinate Latin and algebra.   Whether they apply in the case of subjects other than algebra, remains to be seen.   (1) Practically the whole nomenclature of algebra is Latin or Greek in origin, 96.2% of the 156 words, 97% of the 193 words.   (2) French is the most useful of the modern languages.  Of the 156 words, 96 come through the French.   (3) Comparatively few words can be taught economically, in first-year Latin with our present text-books, at best 56%.   Yet it is worth while to teach these.   (4) To avoid adverse criticism, it is best to give definite information to the mathematics teachers, as to what assistance can be expected from Latin teachers.   (5) The comparatively low percentage of Latin words which can be taught in first-year Latin, does not *necessarily* mean that our first-year books are at fault, and that these should have their vocabulary lists revised.   It may well be argued that in the etymology teaching of the first year, emphasis

should be laid on the words in the Latin vocabularies which furnish numerous English derivatives in common use, as well as on a few prefixes and suffixes. What seems most urgently needed is the determination of Latin stems appearing most frequently in common English words, and the insertion of these stems in first-year books.

## THE LIST

Words of non-Latin origin.

| | | |
|---|---|---|
| 1. | algebra | Low L. — Arabic |
| 2. | zero | Fr. — Ital. — Low L. — Arabic |
| 3. | check | Fr. — Arabic — Persian |
| 4. | bracket | Fr. — Span. — L. — Celtic |
| 5. | root | Scandinavian |
| 6. | standard | Old High German |
| 7. | pi | Greek |
| 8. | parenthesis | Greek |
| 9. | arithmetic | Fr. — L. — Greek |
| 10. | base | same |
| 11. | brace | " |
| 12. | cube | " |
| 13. | geometry — trical | Fr. — L. — Greek |
| 14. | graph — ical | same |
| 15. | horizontal | " |
| 16. | hypotenuse | " |
| 17. | mathematics | " |
| 18. | method | " |
| 19. | parallel | " |
| 20. | parallelogram | " |
| 21. | period | " |
| 22. | problem | " |
| 23. | pyramid | " |
| 24. | symbol | " |
| 25. | topic | " |

Words of Latin origin.

Explanation.

A dash, —, means "derived from."

L = Latin

F = French

P.P. = perfect participle

Pr.P. = present participle

Ger. = gerundive

1 b is the first semester of high school; 1 a, the second; 2 b, the third; 2 a, the fourth; 3, the third year.

Derivation is taught from the Latin word in the column headed "When Taught;" when there is no such entry, from the last word in the column headed "Derivation."

The numbers at the extreme right of each line refer to the lessons in
D'Ooge, in the case of 1 b and 1 a words, and to the book and chapter
of the Gallic War in the case of 2 b and 2 a words.

| Word | Derivation | When Taught | |
|---|---|---|---|
| 1. abscissa | L p.p. of abscindere | 2a scindere | 3:5 |
| 2. absolute | L p.p. of absolvere | 2a solvere | 4:23 |
| 3. add-end-ition | L addere | 1b dare | 5 |
| 4. alter-nate-nation | L p.p. of alternare—alternus—  alter | 1b | 16 |
| 5. altitude | F — L altitudo—altus | 1b | 8 |
| 6. amount | F — L ad montem | 1a | 44 |
| 7. angle | F — L angulus | 3 and in | 5:13 |
| 8. antecedent | L pr.p. of antecedere | 1b discedere 30 | |
| 9. applied | F — L applicare | | 6:27 |
| 10. approximate | L p.p. of approximare | 1b proximus 22 | |
| 11. area | L area | | |
| 12. ascending | L ascendere | 2b | 1:21 |
| 13. axis | L axis | | |
| 14. balance | F — L bilanx — bi+lanx | | |
| 15. binomial | L Late L. binomius —  bi+nomen | 1a nomen | 51 |
| 16. cancel | F — L Low L cancellare —  cancellus | | |
| 17. circle | F — L circulus — circus | 1a circum | 60 |
| 18. circumference | L circumferentia — pr.p. of  circumferre | 1a ferre | 73 |
| 19. clear | F — L clarus | 1b | 8 |
| 20. coefficient | L co+pr.p. of efficere | 1b facere | 26 |
| 21. column | L columna; allied to collis | 1a collis | 44 |
| 22. combine | L combinare — com—+bini | 1a bini | 59 |
| 23. comparison | F — L comparatio—comparare  — com—+par | 1a par | 45 |
| 24. complement-ary | L complementum — complere | 1b plenus | 32 |
| 25. complex | L p.p. of complecti — com —  + plectere | 2b complecti 1:20 | |
| 26. complicate | L p.p. of complicare —  com —+plicare | | |
| 27. composition | F — L compositio —  componere | 1b ponere | 37 |
| 28. common | F — L communis | 2a | 2:4 |
| 29. commutative | L commutare — com —+  mutare | 2b | 1:23 |
| 30. condition-al | F — L conditio — con —+  dic — (show) | 2b conditio | 1:28 |
| 31. consequent | L pr.p. of consequi | 1a | 60 |
| 32. coördinate | L co—+p.p. of ordinare —  ordo | 1a | 40 |
| 33. degree | F — L de+gradus | 3 | 1:11 |

| 34. denominator | L denominare | 1a nominare 79 |
| 35. derive | F — L derivare — de+rivus | 2 |
| 36. descending | F — L descendere — de + scandere | 2b ascendere 1:21 |
| 37. difference | F — L differentia — pr.p. of differre | 1a ferre 73 |
| 38. digit | L digitus | 2a 3:13 |
| 39. dissimilar | F — L dissimilis | 1a 54 |
| 40. divide-nd divisor, division | L dividere | 2b 1:1 |
| 41. eliminate-tion | L p.p. of eliminare—ex+limen | |
| 42. equal, equation | L aequalis and aequatio, both from aequus | 1a aequus 57 |
| 43. equivalent | F — L pr.p. of aequivalere — aequus+valere | 1a both 57 |
| 44. example | F — L exemplum — eximere | 2b exemplum 1:8 |
| 45. exponent | L pr.p. of exponere | 1b ponere 37 |
| 46. express-ion | F — L p.p. of exprimere | 1a premere 59 |
| 47. extreme | F — L extremus | 1a 55 |
| 48. factor | L factor — facere | 1b 26 |
| 49. formula | L formula — forma | 1b 20 |
| 50. fraction-al | F — L fractio—frangere | 2a 4:29 |
| 51. fulcrum | L fulcrum—fulcire | |
| 52. fundamental | F — L fundamentum — fundare | 3 |
| 53. identity | F — L Late L identitas — idem | 1a 50 |
| 54. imagin-e-ary | F — L imaginari — imago | 3 3:5 |
| 55. in-consistent | L in+pr.p. of consistere | 2b 1:13 |
| 56. in-dependent | L in+pr.p. of dependēre | 2b impendēre 1:6 |
| 57. in-determinate | L in +p.p. of determinare—terminus | 3 |
| 58. index | L index. Allied to indicare | 3 |
| 59. indicate | L p.p. of indicare | 2 See "condition" |
| 60. inte-ger-gral | L integer — in+tangere | 2a integer 3:4 |
| 61. interest | F — L interest | 1a 73 |
| 62. introduction | F — L introductio — introducere | 1b ducere 23 |
| 63. inver-sely-sion | F — L p.p. of invertere | 1a vertere 47 |
| 64. jointly | F — L iungere | 2b 1:8 |
| 65. letter, literal | F — L litteralis and littera | 1a littera 49 |
| 66. lever | F — L levator — levare — levis | 2a levis 2:10 |
| 67. linear | L linearis — linea — linum | 2a linum 3:13 |
| 68. mean | F — L medianus — medius | 1a 53 |
| 69. member | F — L membrum | 2a 4:24 |

| | | | |
|---|---|---|---|
| 70. minuend | L ger. of minuere | (1a minus | 55 |
| | | (2b minuere | 1:20 |
| 71. minus | L minus | 1a | 55 |
| 72. miscellaneous,) | L(miscellaneus—miscere | 3 | |
| mixed ) | ( p.p. of miscere | | |
| 73. monomial | L and Gr. monos +nomen | 1a | 51 |
| 74. multi-ple-ply-plier) | L and (multiplicare—multiplex | | |
| multipli-cand-cation) | F—L (multus +—plex—plicare | 1b multus | 12 |
| 75. negative | F — L negativus — negare | 1a | 72 |
| 76. number | F — L numerus | 1b | 17 |
| 77. numerator | L numerator—numerare — | | |
| | numerus | 1b | 17 |
| 78. operation | F — L operatio — operari — | | |
| | opera | 1a opus | 41 |
| 79. opposite | F — L p.p. of opponere | 1b ponere | 37 |
| 80. ordinate | F — L p.p. of ordinare — ordo | 1a | 40 |
| 81. original | F — L origo — oriri | 1a | 60 |
| 82. partial | F — L Late L partialis — | | |
| | pars | 1a | 50 |
| 83. percentage | L per centum | 1a centum | 58 |
| 84. plus | L plus | 1a | 55 |
| 85. polynomial | F — L and Gr. poly + | | |
| | nomen | 1a nomen | 51 |
| 86. positive | F — L positivus — p.p. of | | |
| | ponere | 1b | 37 |
| 87. power | F — L 8th century potere = | | |
| | posse | 1b | 37 |
| 88. preface | F — L praefatio — praefari | 3 fateri | |
| 89. prefix | F — L p.p. of praefigere | 3 figere | |
| 90. prime | F — L prima (hora) — primus | 1a | 48 |
| 91. process | F — L processus — procedere | 1b discedere | 30 |
| 92. product | L p.p. of producere | 1b ducere | 23 |
| 93. properties | F — L proprietas — proprius | 3 | 1:5 |
| 94. proportion-al | F — L proportio — pro + | | |
| | portio, allied to pars | 1a | 50 |
| 95. pure | F — L purus | 3 | |
| 96. quadratic | L p.p. of quadrare — quadrus, | | |
| | allied to quattuor | 1a | 58 |
| 97. quantity | F — L quantitas — quantus | 2b | 1:17 |
| 98. quotient | L or F—L quotiens — quot | 2b | 1:29 |
| 99. radical | F — L radix. Cognate with | | |
| | "root." | | |
| 100. ratio | L ratio. cf. p.p. of reri | 2b ratio | 1:28 |
| 101. rectangle | F — L rectangulus — rectus | | |
| | + angulus | (3 recta | 1:9 |
| | | (See "angle" | |
| 102. reduce, reduction | L reducere | 1b ducere | 23 |
| 103. relation | F — L relatio — referre | 1a ferre | 73 |

| | | | |
|---|---|---|---|
| 104. remainder | F — L remanere | 1a manere | 52 |
| 105. represent | F — L repraesentare — praesens | 2b praesentia | 1:15 |
| 106. result | F — L resultare — resilire — re+salire | 1a desilire | 52 |
| 107. satisfy | F — L Late L satisficare — satisfacere | 1a satis (1b facere | 52 26 |
| 108. select | L p.p. of seligere — se—+ legere | 2a colligere | 3:6 |
| 109. sign | F — L signum | 1a | 45 |
| 110. similar | F — L similis (as if from similaris) | 1a | 54 |
| 111. simplify | F — L simplex + —ficare — facere | (1b facere (3 simpliciter | 26 |
| 112. simultaneous | L Late L simultaneus — simul | 2b | 1:19 |
| 113. solve, solution | L and F — L solvere | 2a | 4:23 |
| 114. special | F — L specialis — species | 2a | 2:31 |
| 115. squar-e-ing | F — L quadrare — quadrus, related to quattuor | 1a | 58 |
| 116. substitute | F — L p.p. of substitutus— sub+statuere | 1a | 56 |
| 117. subtract-ion) subtrahend) | L p.p. and ger. of subtrahere | 1a trahere | 57 |
| 118. sum | F — L summa — summus | 1b | 39 |
| 119. summary | F — L summarium — summa — summus | 1b | 39 |
| 120. supplement-ary | F — L supplementum — supplere | 1b plenus | 32 |
| 121. surd | L surdus | | |
| 122. term | F — L terminus | 3 | |
| 123. transpose | F — L and Gr. trans+Late L pausa | | |
| 124. triangle | F — L triangulum — tri—+ angulus | (1a tres (See "angle" | 58 |
| 125. trinomial | L tri—+nomen | (1a tres (1a nomen | 58 51 |
| 126. unit | F — L unitas — unus | 1b | 16 |
| 127. use | F — L usus (n) related to p.p. of uti | 2b uti | 1:5 |
| 128. value | F — L valere | 1a | 57 |
| 129. varia-ble-tion | F — L variabilis and variatio — variare — varius | 2a | 2:22 |
| 130. vertical | F — L verticalis — vertex | | |
| 131. vinculum | L vinculum — vincire | 2b vinculum | 1:4 |